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Limiting Exposure to Isoflurane in a Veterinary Occupational Setting

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Abstract

This paper characterizes the veterinary occupational health hazards of waste anesthesia gas. A needs assessment was conducted to develop educational materials on hazard and control.

Recommendations were made to HESIS on need for educational products.

Limiting Exposure to Isoflurane in a Veterinary Occupational Setting

Introduction

The Hazard Evaluation System and Information Service (HESIS) received calls from employees in a veterinary clinic and hospital expressing concerns about their possible exposure to anesthetic gas, cadmium, and lead used in their workplaces. In 2015, site visits by the HESIS team noticed employees exposed to anesthetic gas in the worksite. Separately, Cal/OSHA Consultation Service reports from 2008 to 2011 indicated citations for lack of exposure monitoring of waste anesthetic gas (WAG) in some veterinary clinics or hospitals (See Appendix B).

Background

Discussions, research, and interviews began to determine, is there a WAG exposure problem, what populations are effected, what is already being done to minimize exposure? The potential health effects of exposures to WAG generally, including isoflurane, are of concern at high concentrations and may be of concern at occupational level exposures. Preliminary information indicates workplace complacency and bad information available to veterinarians and veterinarian technicians. There are 3,500 veterinary hospitals and clinics in California. The 3,500 veterinary hospitals and clinics include fixed, mobile, vaccine, spay & neuter clinic according to P. Rodriguez, Veterinary Medical Board (personal communication, August 11, 2015).

Hazard Evaluation System and Information Service (HESIS)

The HESIS program is part of the Occupational Health Branch (OHB) in the California Department of Public Health (CDPH). HESIS has worked to prevent workplace illness and disease using science, medical, and public health expertise. HESIS identifies and evaluates new

and inscrutable chemical hazards in the workplace. HESIS creates health alerts and other practical information on chemical hazards to give to employers and employees for their use in occupational settings. HESIS collaborates with employer groups, unions, stakeholders, and other to distribute important hazard information on workers at risk. Using literature searches, interviews and site visits, HESIS evaluates scientific information on potential hazards to prevent worker illness and disease. HESIS recommends preventative and protective occupational health standards (HESIS, 2015).

The interdisciplinary HESIS Team consists of Certified Industrial Hygienist, Health Educator, Epidemiologist, Occupational Health Doctor, Research Scientist, Registered Environmental Health Specialist, Staff Toxicologist. Some members of the team hold one or more specialties.

HESIS, a program in CDPH, share occupational safety issues and industrial hygiene concerns with the California Department of Industrial Relations, Division of Occupational Safety and Health (DOSH), commonly known as Cal/OSHA. Cal/OSHA has enforcement powers over a workplace. As an example of enforcement powers over a workplace, Cal/OSHA can order the immediate closure of a workplace. Cal/OSHA relies on CDPH (including HESIS) for the science, medical, and public health expertise over health effects and other research of hazards existing in the workplace.

CDPH has no enforcement powers over a workplace but does work with employers and employees on workplace hazards. CDPH can refer workplace hazards to Cal/OSHA.

The Veterinary Hazards Project

Learning Objectives

The Veterinary Hazards Project is to identify a need for and develop educational materials on occupational hazards in the veterinary industry. There were three learning objectives. The first was to characterize the occupational health hazards from the Hazard Evaluation System and Information Service (HESIS) evaluation of the hazards. The veterinary occupational health hazards focused on the potential exposures to anesthesia gas. The anesthesia gas used in the majority of veterinary occupational settings was isoflurane. Characterizing the health hazards included listing the health effects of anesthesia gas.

The needs assessment including site visits, interviews of veterinarians, and interview of key stakeholders in the development of educational materials on hazard and control of anesthesia gas. The needs assessment included reviewing information readily available not duplicating what is already available to veterinarians and veterinarian technicians.

The final learning objective was to make recommendations to HESIS on the need for educational products. The recommendations would be the starting point of an extensive CDPH review process, beginning with an Occupational Health Branch's internal review.

Methods and Tasks

The methods and tasks of this project included literature searches, meetings with subject matter experts (SMEs), visiting workplaces, and interviewing key stakeholders. The methods and tasks are further refined in the two page attachment to this paper titled, Supervised Field Training in Public Health, Scope of Work and Timeline.

Finding/Results

The three key stakeholders interviewed agreed there is a sense of ease or complacency working around anesthesia machines and anesthesia gas in veterinary occupational settings.

Radiation training is emphasized in veterinary and veterinary technicians training. Mandatory inspections by the Veterinary Medical Board of veterinary clinics also focus on radiation safety. [(A. Moon, President Board, CaRVT, personal communication, June 22, 2015), (P. Rodriguez, Veterinary Medical Board, August 11, 2015), (B. Schrock, President, VetEquip, Inc., personal communication, July 28, 2015)].

The three key stakeholders interviewed were in agreement that isoflurane is the most common anesthetizing gas in veterinary occupational settings [(A. Moon, President Board, CaRVT, personal communication, June 22, 2015), (P. Rodriguez, Veterinary Medical Board, August 11, 2015), (B. Schrock, President, VetEquip, Inc., personal communication, July 28, 2015)]. Isoflurane is odorless and colorless chemical. Isoflurane quickly enters and leave the brain when removed from exposure.

Isoflurane is found to be neurotoxic in a wide variety of animal species at experimental levels, including nerve cell death, reduced and altered nerve cell growth, and learning and memory impairment. Adverse reproductive effects including reduction in spermatogenesis with altered sperm morphology in males, and maternal toxicity, reduced fetal growth, and fetal abnormalities in females (Appendices A and C).

In humans, the potential health effects of WAG in general (including isoflurane) in high concentrations include headache, hypotension, tachycardia, respiratory depression. In low concentrations: miscarriages, genetic damage, and cancer among operating-room workers (Appendices A and C).

The potential health effects of isoflurane in humans at occupational level exposures, (where both isoflurane and nitrous oxide were in use) have demonstrated some neurological effects including effects on balance and breathing control (Appendix A). Isoflurane is found to

be neurotoxic in a wide variety of animal species at experimental levels, including nerve cell death, reduced and altered nerve cell growth, and learning and memory impairment (Appendix C).

Limitations

There needs to be more site visits and interviews of key stakeholders. The author was not able to interview or visit veterinary and veterinary technician education facilities. The veterinary education facilities may be a resource to emphasize the hazards of anesthesia gas exposures with the same robust teaching of radiation safety.

Public health Significance/Conclusion

With proper and routine maintenance of anesthesia machines, isoflurane and other anesthesia gases, veterinary occupational setting can minimize potential exposures to WAG. The original Cal/OSHA Standards Board adopted the PEL of 2 ppm (over a time-weight average of 60 minutes) because 2ppm could be “doable” by the industry in the decade of the 1990s. Regular maintenance, monitoring, and record keeping by workers in veterinary occupational settings are all “doable.”

University of San Francisco Master of Public Health Program Competencies

- 1) **Assess, monitor, and review the health status of populations and their related determinants of health and illness.**

The author created and used the interview scripts interview key informants and stakeholders in veterinary field (Appendix E, Veterinary Health Partners Recruitment Questionnaire). Interviews were completed with: veterinary technicians; a veterinarian owner; Ms. Allyson Moon, CaRVT, President, Board of California Registered Veterinarian Technicians Association (CaRVT); Ms. Patty Rodriguez, Hospital Inspection Program, California Veterinary

Medical Board, Department of Consumer Affairs; and Mr. Bob Schrock, President, VetEquip, Inc.

Each interviewee was asked questions concerning workers' exposure to WAG and what hazards need to be addressed in veterinary settings. All the interviewees indicated exposure to WAG was not something either being address or needing to be addressed. The veterinary technicians were concerned about their exposure to WAG.

2) Demonstrate the ability to utilize the proper statistical and epidemiologic tools to assess community needs and program outcomes.

In Appendix B, the chart presents the Cal/OSHA Consultation report findings (and regulation citations) from visits to veterinary hospitals and clinics occurring from 2008 to 2012.

The author reviewed Cal/OSHA literature from labor, management, industry, and government meeting to determine an isoflurane exposure level. Cal/OSHA sets the exposure level at 2 ppm (part per million) (Cal/OSHA Standards Board, Feb 1991). No federal Occupational Safety and Health Administration (OSHA) exposure level to isoflurane or WAG has been established (OSHA, 2015). There are no other authoritative bodies recognizing isoflurane (Appendix D).

The number of veterinary workers and workplaces were found by using the U.S. Census Bureau, NAICS (North American Industry Classification System) site. The search of the NAICS site used NAICs code: 541940 for Animal Hospitals. The U.S. Census.gov reports that in 2011, in California there are 2816 facilities (not including animal labs or zoos) with 30,784 paid employees including veterinarians, veterinarian technicians, and others (U.S. Census Bureau, 2015). The Veterinary Medical Board estimates there are 3,500 veterinary hospitals and clinics,

including fixed, mobile, vaccine, spay & neuter clinics (P. Rodriguez, personal communication, August 11, 2015).

3) Identify and prioritize the key dimensions of a public health problem by critically assessing public health literature utilizing both quantitative and qualitative sources.

A key question at the beginning of the Veterinary Hazards project was, is there a public health problem? Is WAG a public health problem in veterinary work sites large enough to warrant government attention? To answer these questions, HESIS began a literature review, queried Cal/OSHA, and examine results of veterinary hospitals and clinics site reviews.

A review of information was conducted on WAG including halogenated anesthetic gases and isoflurane. The easily found websites of veterinary schools, governmental organizations, professional associations, and other stakeholder group was reviewed to found potential interview candidates to learn more about what hazards needed addressing in veterinary settings. HESIS has an internal physical library of occupational effects of isoflurane, nitrous oxide, and other halogenated anesthetic gases. The HESIS internal library was searched for occupational articles written prior to the current age of digital documentation.

The author created Appendix A, Potential Health Effects, from the author's research, meetings with other HESIS team members. Meetings with the HESIS Staff Toxicologist, Research Scientists, and Registered Environmental Health Specialists (REHS) added, deepened, and refined the author's literature searches.

Each of the Cal/OSHA Consultation reports on the seven veterinary work site visits. A review was conducted on each of the twenty CalOSHA references the California Code of Regulations (CCR), in Title 8 (Appendix B).

Veterinary workers expressing concerns about possible site hazards including anesthetic gases called HESIS into two veterinary work sites. A third interview of a veterinary hospital owner was conducted after the veterinarian and owner request a meeting with HESIS. The information on all interviews was captured on the Veterinary Health Partners Recruitment Questionnaire found in Appendix E. The paper's author created the Questionnaire after review and comments by HESIS team members. The Questionnaire was adapted for other interview categories including key stakeholders (e.g., Associations) and a veterinary equipment supplier.

4) Specify approaches for assessing, preventing, and controlling environmental hazards that pose risks to human health and safety.

What occupational health information is already in existence and available for those in veterinary work settings about isoflurane and other WAG? How are workers already protecting themselves, should be protecting themselves.

Proposed key messages to veterinary owners and veterinary workers include monitoring, controlling, awareness, have a formal Illness and Injury Protection Policy (IIPP), training, and training. The California Department of Public Health (CDPH) is developing proposed key messages for approval.

The recommendations for veterinarian owners and managers are that there are health hazards associated with exposures to isoflurane (Appendix A). Administer and maintain the anesthesia machine and keep a log of the maintenance. Use an enclosed key-fill adapter for filling vaporizer with isoflurane. Use effective exhaust ventilation to remove/scavenge vapor. Require daily weighing of the anesthetic machine scavenging gas canister. The canister needs changing prior to no more than 12 hours of usage or when the canister weighs more than 50

grams. Daily proper setup and maintenance of isoflurane equipment reduces potential isoflurane release.

Monitor for waste anesthetic gas (WAG) using inexpensive dosimeter badges worn in the breathing zone (close to mouth and head). Require workers to wear dosimeter badges while working in areas around anesthetic gas equipment.

Understand Cal/OSHA regulations and industry guidance to limit exposures to levels below the California's Potential Exposure Limit (PEL) of 2 ppm (parts per million) (Cal/OSHA, 2015).

Maintain the worksite IIPP using Cal/OSHA (Appendix B), Veterinary Medical Board, and industry guidance. Develop a form reproductive hazards policy (Appendix B) using similar guidance found in maintaining the worksite IIPP.

Recommendations for veterinary technicians include similar messages for veterinarians focusing three areas. There should be a daily inspection and maintenance of the anesthetic machine. Second, daily startup maintenance of anesthesia machine should be annotated in a logbook. Finally, daily weighing of the anesthetic machine scavenging gas canister will assure the canister's scavenging protection is working.

5) Apply theoretical constructs of social change, health behavior and social justice in planning community interventions and 10) Develop public health programs and strategies responsive to the diverse cultural values and traditions of the communities being served.

The areas of social justice include underserved populations. Workers in veterinary settings earn less than the average salary of California workers. Lower earnings and fewer years of education are linked to lower socioeconomic status and are indicators of an underserved

population (Adler, N., 2002). This project has identified occupational hazards in veterinary workplaces. The hazards of exposures to WAG will be communicated to veterinary workers by the educational materials developed by the Veterinary Hazard Work Group, which include this paper's author.

With the exception of the veterinarians, the average salaries of workers in the veterinary field are below the average salary of California workers. According to the U.S. Department of Health and Human Services, the 2014 poverty guideline for a family of four is \$23,850. Those working in a veterinary hospital or clinic (excluding the Veterinarian) are closer to the federal poverty guidelines for salary.

Lower earnings and fewer years of education have been linked to lower socioeconomic status and are indicators of an underserved population. [Adler, N.E. and Newman, K. (March 2002). Socioeconomic disparities in health: pathways and policies. *Health Affairs* 21(2).] With the exception of the veterinarians, the average salaries of workers in the Veterinary field are below the average salary of California workers.

According to the U.S. Department of Health and Human Services (DHHS), the 2014 poverty guideline for a family of four is \$23,850. Those working in a veterinary hospital or clinic (excluding the Veterinarian) are closer to the federal poverty guidelines for salary. The 2014 annual mean wage in California is \$53,890, or median average hourly pay of \$18.84.

According to the Bureau of Labor Statistics, the Veterinary Technologists & Technicians have a median pay in 2012 is \$30,290 or \$14.56/hour. An Associate's degree is the entry education level. Veterinary Assistants and Laboratory Animal Caretaker: median pay in 2012 is \$23,130 or \$11.12/hour. A high school diploma or an equivalent is the entry education level.

Veterinarians' median pay in 2012 was \$84,460 or \$40.61/hour. A Doctoral or professional degree is the entry education level.

7) Apply evidence-based principles to the process of program planning, development, budgeting, management, and evaluation in public health organizations and initiatives.

HESIS is part of the Occupational Health Branch (OHB). OHB does not have resources to mount an advertising campaign to educate workers in veterinary occupational setting. Instead, OHB and HESIS work with key stakeholder, industry, unions, and other to get public health messages to the workers in occupational settings. The collaboration with key groups requires on ongoing relationship and achievable tasks and goals. The Veterinary Hazards Work Group has started and will continue the collaboration process through site visits and interviews of key stakeholders.

8) Demonstrate leadership abilities as collaborators and coordinators of evidence based public health projects and 10) Develop public health programs and strategies responsive to the diverse cultural values and traditions of the communities being served.

As Team Lead for the Veterinary Hazards Work Group, I called and ran the regular HESIS team meetings. I held additional meetings with subject matter experts (SMEs) including the health educator (create key messages for veterinarians and the veterinarian technicians), Research Scientist (review U.S. Census data), and Staff Toxicologist (review chemical classifications and health effects). Continuing issue is bringing everyone together for regular/irregular team meetings.

Appendix F is a Veterinary Hazards Work group meeting agenda to discuss how to communicate educational materials to veterinarians and veterinarian technicians. The

educational materials will be created first in the English language. English is the common language at this time in veterinary occupational settings according to P. Rodriguez, Veterinary Medical Board (personal communication, August 11, 2015). Spanish will be the second language for educational materials.

Personal Reflections on Challenges of Fieldwork Experience

My first half of my fieldwork project was spent becoming familiar with how a workplace is regulated in California. How does Cal/OSHA (California Occupational Safety and Health Administration) versus my organization, the California Department of Public Health (CDPH)? Cal/OSHA has enforcement powers over a workplace. Cal/OSHA relies on CDPH for health effects and research. CDPH has no enforcement powers but does work with employers and employees and CDPH can refer workplace issues to Cal/OSHA.

Understanding some of the relationship between Cal/OSHA and my own CDPH helped me understand what is my preceptor's and my own role, and what is the role of HESIS (Hazard Evaluation System and Information Service) in CDPH. My fieldwork project is to help identify and communicate hazards in the workplace. Specifically, my fieldwork helped me identify and communicate the hazards occupational exposures to anesthetic gases (e.g., isoflurane).

Researching the background on anesthesia gases found that isoflurane is the most commonly used chemical in veterinary clinics and hospitals to calm and put animals to sleep prior to surgery. Isoflurane (commercial names include forane ®) is inexpensive, quickly anesthetizes, and quickly leaves the brain and body.

The initial challenge was finding a field work project related to the mineral lead. I interviewed other programs (e.g., Drinking Water, Environmental Health Investigations) and considered other subjects (e.g. chlorination of drinking water, vast powers of a local health

officer) before finding agreement on a fieldwork internship in HESIS on an occupational hazard. The initial HESIS projects explored with my preceptor were exposures of workers in electronic waste recycling sites, asphalt pavers and roofers, and veterinary hospitals and clinics. My fieldwork in HESIS settled on the probable occupational exposures veterinary workers to WAG, specifically to the most commonly used anesthesia, isoflurane.

My internship is located in proximity to my present regular position in Childhood Lead Poisoning Prevention Branch (CLPPB). In addition to my responsibilities as a manager and Section Chief in CLPPB, I directly supervise seven persons and indirectly supervise others. My Operation Support Section, handles, procurements, personnel, legal, financial inflows, six labor bargaining units, contracts with 43 local health jurisdictions. I had to take vacation time-off from CLPPB during my fieldwork project. My regular CLPPB position duties, issues, and staff continue to reach-out to me during my HESIS fieldwork while I was on 'vacation' from CLPPB.

This experience has grown my public health concern because workers continue to be occupationally exposed chemicals and agents that have been proven harmful. There are other harmful exposures yet to be identified. The 'precautionary principle' does not apply to known or unknown agents. Workers and work settings should not be exposed to possible harm.

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Appendix A

I. Potential Health Effects - How severe is the potential injury or illness?

a. Waste anesthetic gases (general, including isoflurane):

Exposure to high concentrations of waste anesthetic gases, including isoflurane, may cause the following health effects: headache, irritability, fatigue, nausea, drowsiness, vomiting, irritation (eye, skin, nose, and throat), difficulties with judgment and coordination, and liver and kidney disease. Chronic effects may include hypotension, tachycardia, respiratory depression, and elevated blood glucose levels. Although some studies report no adverse health effects from long-term exposure to low concentrations of waste anesthetic gases, several studies have linked such exposure to miscarriages, genetic damage, and cancer among operating-room workers (Kathleen Attfield, ScD, HESIS Team).

b. Isoflurane specifically:

Occupational level exposures to isoflurane have not been widely studied, however some of the existing studies (where both isoflurane and nitrous oxide were in use) have demonstrated some neurological effects including effects on balance and breathing control. Isoflurane has been found to be neurotoxic in a wide variety of animal species at experimental levels, with effects including nerve cell death, reduced and altered nerve cell growth, and learning and memory impairment. Additionally, animal studies have shown adverse reproductive effects including reduction in spermatogenesis with altered sperm morphology in males, and maternal toxicity, reduced fetal growth, and fetal abnormalities in females. Isoflurane is not mutagenic and has not been demonstrated to be carcinogenic, though IARC has not evaluated it since 1987, however recent research is focusing on a possible role of isoflurane in cancer reoccurrence. (Kathleen Attfield, ScD, HESIS Team).

c. Symptoms of exposure to waste anesthetic gases. Waste anesthetic gases include both nitrous oxide and halogenated anesthetics such as isoflurane. [NIOSH. (2007). Waste Anesthetic Gases: Occupational Hazards in Hospitals. p.1]

- i. There is no specific work exposure limit established for FORANE (isoflurane, USP). However, the National Institute for Occupational Safety and Health Administration (NIOSH) recommends that no worker should be exposed at ceiling concentrations greater than 2 ppm of any halogenated anesthetic agent over a sampling period not to exceed one hour.

- ii. Effects of exposure to high concentrations: Exposure to high concentrations of waste anesthetic gases—even for a short time—may cause the following health effects: headache, irritability, fatigue, nausea, drowsiness, difficulties with judgment and coordination, liver and kidney disease [NIOSH. (2007). Waste Anesthetic Gases: Occupational Hazards in Hospitals. p.2]
 - iii. Effects of exposure to low concentrations: Although some studies report no adverse health effects from long-term exposure to low concentrations of waste anesthetic gases, several studies have linked such exposure to miscarriages, genetic damage, and cancer among operating-room workers. Studies have also reported miscarriages in the spouses of exposed workers and birth defects in their offspring. Therefore, NIOSH is concerned about worker exposures to these gases and recommends controls to prevent exposures. [NIOSH. (2007). Waste Anesthetic Gases: Occupational Hazards in Hospitals. p.3]
- d. Cal OSHA's Permissible Exposure Limit (PEL) for isoflurane is 2 ppm (or 15mg/m³). The Chemical Aspects Registry Number (CARN) for isoflurane is 26675-46-7. (http://www.dir.ca.gov/title8/5155table_ac1.html)
- e. Federal OSHA standards do not address waste anesthetic gases.
<https://www.osha.gov/SLTC/wasteanestheticgases/index.html>
- f. Malignant Hyperthermia - Halogenated inhalation anesthetic agents such as isoflurane, halothane, sevoflurane and desflurane, are known to trigger a clinical syndrome called Malignant Hyperthermia in susceptible individuals receiving general anesthesia. It is potentially fatal. "The syndrome includes nonspecific features such as muscle rigidity, tachycardia, tachypnea, cyanosis, arrhythmias, and unstable blood pressure. (It should also be noted that many of these nonspecific signs may appear with *light anesthesia*, acute hypoxia, etc.)" (Reference Baxter Drug Label) Susceptible individuals have a genetic mutation in receptors of the calcium channels in the skeletal muscles. See also Hopkins 2011

g. Acute Exposure Symptoms to Isoflurane

- i. Nausea, vomiting, irritation (eye, skin, nose, and throat), headache, dizziness, drowsiness. [U.S. Army. (2004). Guidelines for the recognition, evaluation, and control of occupational exposure to waste anesthetic gases. TB Med 510. P28]

h. Chronic Exposure Symptoms to Isoflurane

- i. Hypotension, tachycardia, respiratory depression, elevated blood glucose levels. [U.S. Army. (2004). Guidelines for the recognition, evaluation, and control of occupational exposure to waste anesthetic gases. TB Med 510. P28]

i. Neurological Effects

- i. The PEL was set based on reproductive effects. Occupational level exposures to isoflurane have not been widely studied, however some of the existing studies (where both isoflurane and nitrous oxide were in use) have demonstrated some neurological effects including effects on balance and breathing control. Isoflurane has been found to be neurotoxic in a wide variety of animal species at experimental levels, with effects including nerve cell death, reduced and altered nerve cell growth, and learning and memory impairment. In laboratory experiments, human nerve cell lines also display cell death following exposure to isoflurane. With exposures experienced by humans who have undergone anesthesia, learning disabilities and language abnormalities have been occasionally observed. Additionally, the action of isoflurane on nerve cell death has been a concern to scientists investigating Alzheimer's and Parkinson's disease and other dementias. Due to these known neurotoxic effects and gaps of information on chronic exposures, and lack of awareness and monitoring in this field, we are prioritizing isoflurane as an under recognized exposure concern in veterinary practices

j. Genetic Effects

- i. Currently used inhaled anesthetics (including isoflurane) have no mutagenic potential. Tests for damage to DNA have been negative. [American Society of Anesthesiologists, 1999, p.7).

k. Effects on major organs (liver, kidneys)

No evidence on organ toxicity in mice for isoflurane, halothane, enflurane, and nitrous oxide. [Waste anesthetic gases, p. 8]

l. Causes cancer?

Administration by inhalation of isoflurane, halothane, enflurane, and nitrous oxide in mice show no carcinogenicity. [Waste anesthetic gases, p. 8]

m. Reproductive Effects.

- i. Low concentrations (trace: 0.006, subanesthetic: 0.06%) of isoflurane do not cause reproductive effects in rats. Light anesthetic: 0.6% concentration "resulted in significantly decreased fetal weight, decreased skeletal ossification, minor hydronephrosis, and increased renal pelvic cavitation. The incidence of cleft palate also was significantly increased, abnormalities occurring in 12.1% of fetuses and affecting 11 of 23 litters." (Mazze et al., 1985).
- ii. "Studies in animals have shown reproductive toxicity of isoflurane. The adverse reproductive effects observed include reduction in spermatogenesis with altered sperm morphology in males, and maternal toxicity, reduced fetal growth, and fetal abnormalities in females. There are no adequate and well controlled studies in pregnant women. According to NIOSH, although some studies report no adverse health effects from long-term exposure to low concentrations of such waste anesthetic gases, several studies have linked such exposure to miscarriages among operating-room workers. Studies have also reported miscarriages in the spouses of exposed male workers and birth defects in their offspring. Therefore, it is recommended to take control measures to prevent exposures. It is not known whether isoflurane and its metabolites

are excreted in human milk. Because many drugs are known to be excreted in human milk, it is prudent to exercise caution while handling isoflurane by nursing women.” (Kashyap Thakore, PhD, Staff Toxicologist, HESIS Team).

Appendix B

Table of Hazards from Cal/OSHA Consultation Service Citations found at 7 Veterinary Facilities (Consultations occurred from August 2008 to July 2011)

| Hazard | Cal/OSHA regulation | Number of Facilities Cited |
|--|---|----------------------------|
| 1. Furniture not secured to prevent falling in earthquake | T8CCR 3241(c) http://www.dir.ca.gov/Title8/3241.html | 4 |
| 2. Anesthetic exposure not measured | T8CCR 5155(e)(1), http://www.dir.ca.gov/Title8/5155.html | 6 |
| 2.1 Exposures to sevoflurane must be periodically assessed and compared to NIOSH recommended exposure limit (2 ppm ceiling limit, measured for no more than an hour) in order to ensure adequate control of potentially harmful exposures. | T8CCR 5155(e)(1), http://www.dir.ca.gov/Title8/5155.html | 1 |
| 3. Lacking Eyewash available for employees use when using disinfectants and cleaners. | T8CCR 5162(a), www.dir.ca.gov/Title8/5162.html | 4 |
| 4. Lack of reproductive hazards policy | No regulation cited. Call Health Evaluation System and Information Service (HESIS), CDPH | 5 |
| 5. Ensure general dilution ventilation meets minimum recommended rates (for circulation and replenishment in all rooms/areas in which anesthetic gas is used. At least annual ventilation audit. | T8CCR 5155(e)(1), http://www.dir.ca.gov/Title8/5155.html | 5 |
| 6. Lack of negative pressure in animal isolation room | T8CCR 5155(e)(1), http://www.dir.ca.gov/Title8/5155.html | 1 |
| 7. Lack of effective procedures for preventing aerosol transmissible diseases | T8CCR 5199.1(a)(2)(A), www.dir.ca.gov/Title8/5199-1.html . | 2 |
| 8. Power strip used in lieu of fixed wiring | T8CCR 2305.4, http://www.dir.ca.gov/Title8/2305_4.html | 1 |
| 9. Lack of an injury and illness prevention program | T8CCR 3203(a), www.dir.ca.gov/Title8/3203.html | 7 |
| 10. Lack of space about electrical equipment | T8CCR 2340 (16) (a), http://www.dir.ca.gov/Title8/2340_16.html | 1 |
| 11. Develop, implement and maintain written hazard communication program | T8CCR 5194(e)(1) http://www.dir.ca.gov/Title8/5194.html | 2 |
| 12. Ensure that each container is labeled with the identity of hazardous contents and appropriate hazard warnings | T8CCR 5194(f)(4) http://www.dir.ca.gov/Title8/5194.html | 1 |
| 13. Ensure that there is a MSDS for each hazardous substance used. | T8CCR 5194(g)(1) http://www.dir.ca.gov/Title8/5194.html | 1 |
| 14. Establish, implement, and maintain effective procedures for preventing employee exposure to aerosol transmissible zoonotic pathogens | T8CCR 5199.1 (a)(2)(A) http://www.dir.ca.gov/Title8/5199-1.html | 1 |
| 15. Ensure that all portable fire extinguishers are properly wall-mounted and visually inspected monthly. | T8CCR 6151 (c)(1) & (2) http://www.dir.ca.gov/Title8/6151.html | 1 |
| 16. Log 300 and 300A forms must be accurately completed on an annual basis. | T8CCR 14300.1 (a)(2) http://www.dir.ca.gov/Title8/14300_1.html | 4 |
| 17. Electrical receptacles within 6 feet of the sink in the Grooming Area must be GFCI-protected | T8CCR 2340 2 (a) http://www.dir.ca.gov/Title8/2340_16.html | 2 |
| 18. The strain relief on one pendant receptacle in boarding | T8CCR 2500.10 (a) | 1 |

| | | |
|-----------------------|---|--|
| room must be repaired | http://www.dir.ca.gov/Title8/2500_10.html | |
|-----------------------|---|--|

Appendix C

| Isoflurane Reproductive Toxicity | | | |
|---|--|--|---|
| Research Articles | Isoflurane exposure | Results | Conclusions |
| Beilin et al. (1999) - The use of propfol, nitrous oxide, or isoflurane does not affect the reproductive success rate following gamete intrafallopian transfer (GIFT): a multicenter pilot trial/survey. | Medical record information of women who underwent gamete intrafallopian transfer (GIFT) during years 1993 and 1994 at the fertility programs in the United States. | Data on 455 women were collected; the clinical pregnancy rate (number of pregnancies/total number of GIFT procedures) was 35% and the delivery rate (number of women who delivered at least one live baby/total number of GIFT procedures) was 32%; No statistically significant difference in clinical pregnancy or delivery rates between those women who received isoflurane during GIFT and those who did not. | No isoflurane-related differences in pregnancy rates were found when isoflurane was used as part of anesthetic technique for GIFT. |
| Campion et al. (2012) - Isoflurane reduces motile sperm counts in the Sprague-Dawley rat. | Male rats were exposed to either standard 5-min CO(2) euthanasia (flow rate of 3L/min), 10 min CO(2) euthanasia (flow rate of >3L/min) or 5-minute 5% isoflurane anesthesia followed by exsanguination; animals were sacrificed for sperm counts. | Isoflurane anesthesia reduced sperm count to 3.3 sperm/field and only 60.7% motile sperm compared to 65.6% sperm/field and 94.3% motile sperm after CO(2) euthanasia; the 10 min CO(2) euthanasia shown partial reduction (34.6 sperm/field and 77.6 motile sperm). | Isoflurane inhibited contraction of the smooth muscle of the vas deferens, resulting in a decreased number of expelled sperm in rats. |
| Ceyhan et al. (2005) - Effects of exposure to new inhalational anesthetics on spermatogenesis and sperm morphology in rabbits. | Male rabbits were exposed to 1.3% isoflurane for 20 hrs (4 hrs per day for 5 days) and semen was collected at different days after exposure for sperm concentration, motility and morphological changes; testicular biopsies on 41st day for light microscopy. | Significant decrease in sperm concentration and motility and injury to spermatogenic cells after isoflurane exposure as compared to control. | Chronic exposure to isoflurane had negative effects on spermatogenesis and sperm morphology. |
| Fujinaga et al. (1987a) - Reproductive and teratogenic effects of nitrous oxide, isoflurane, and their combination in Sprague-Dawley rats. | Timed-pregnant Rats were exposed to either nitrous oxide or nitrous oxide plus 0.35% isoflurane for 24 hr on day 8 of pregnancy; on day 20 of pregnancy, offsprings were delivered and examined for external abnormalities and visceral or skeletal abnormalities. | Nitrous oxide alone caused significantly higher incidence of early and late resorptions, and major visceral malformations; Nitrous oxide plus isoflurane caused very low such incidences. | The addition of isoflurane to nitrous oxide prevented the majority of these adverse effects. |

| | | | |
|--|--|--|---|
| Fujinaga et al. (1987b- Abstract) - Reproductive and teratogenic effects of isoflurane, nitrous oxide and their combination in Sprague-Dawley rats. | Timed-pregnant rats were exposed to either 50% nitrous oxide or nitrous oxide plus 0.35% isoflurane for 24 hr on day 9 of pregnancy; on day 21 of pregnancy, offsprings were delivered and examined for external abnormalities and visceral or skeletal abnormalities. | No difference in pregnancy rate, total number of implantations, live fetuses per litter, and mean fetal weight among all groups; incidence of skeletal developmental variants was higher in both nitrous oxide alone and combination groups. | Isoflurane partially antagonized the reproductive and teratogenic effects of nitrous oxide in rats. |
| Kennedy et al. (1977) - Reproductive and teratogenic studies with isoflurane. | (i) Rats were exposed to isoflurane prior to mating, during various stages of gestation, and during late pregnancy to see effects on reproduction, fetal development, and fetal survival respectively; and (ii) Rabbits were exposed to isoflurane just during various stages of gestation (see article for exposure details). | No adverse reproductive or teratogenic effects were observed; fetal survival was low in rats exposed during late pregnancy. | Isoflurane did not cause reproductive or teratogenic effects, but it may affect fetal survival in rats. |
| Land et al. (1981) - Morphologic changes in mouse spermatozoa after exposure to inhalational anesthetics during early spermatogenesis. | Male mice were exposed to either 0.10% or 1.0% isoflurane for 20 hrs (4 hr/day for 5 days) during early spermatogenesis; 28 days after exposure epididymal spermatozoa were examined. | No significant increase in percentage of abnormal spermatozoa were found after isoflurane exposure. | Isoflurane is not toxic during spermatogenesis in mice. |
| Mazze (1985a) - Fertility, reproduction, and postnatal survival in mice chronically exposed to isoflurane. | (i) Female mice were exposed to either 0.4% or 0.1% isoflurane for 4 hr daily for 2 weeks before and during pregnancy; (ii) Male mice were exposed to either 0.4% or 0.1% isoflurane for 4 hr daily through out spermatogenesis and during mating. | (i) No effect on fertility, reproduction wastage, and postnatal survival of the offspring in female mice; (ii) No effect on fertility in male mice and reproductive wastage of the unexposed female mates. | Isoflurane did not alter female or male fertility, reproduction, or postnatal survival of offspring; Isoflurane at low level may not cause reproductive harm to operating room personnel. |
| Mazze et al. (1985b- Abstract) - Reproductive effects of the inhalation anesthetics, halothane, enflurane, isoflurane and nitrous oxide. | Time-pregnant SD rats were exposed to 1.05% isoflurane (anesthetic concentration) for 6 hr either on days 8-10, 11-13, or 14-16 and sacrificed on day 21. | No effect on the number, sex and weight of live fetuses, number of corpora lutea and implantations, number of resorptions and dead fetuses. | Isoflurane do not cause reproductive effects in rats. |

| | | | |
|--|--|---|--|
| Mazze et al. (1985c) - Fetal development in mice exposed to isoflurane. | Mice were exposed to either 0.006%, 0.06%, or 0.6% isoflurane for 4 hr daily on days 6-15 of pregnancy; on day 18 dams were killed to determine number and position of live and dead fetuses, and resorptions. | No difference in litter size or sex ratio; fetuses from 0.6 % isoflurane group showed weight loss, increased incidence of cleft palate, reduced skeletal ossification, minor hydronephrosis, and increased renal pelvic cavitation compared to control. | Clinical concentration (0.6%) of isoflurane, not the lower concentrations, is teratogenic. |
| Mazze et al. (1986) - Reproductive and teratogenic effects of nitrous oxide, halothane, isoflurane, and enflurane in Sprague-Dawley rats. | Time-pregnant SD rats were exposed to 1.05% isoflurane for 6 hr either on days 8-10, 11-13, or 14-16 and sacrificed on day 21 to examine reproductive as well as external, internal and skeletal abnormalities in offspring. | No reproductive and major or minor teratogenic effects in isoflurane group. | Isoflurane is neither reproductive toxin nor teratogenic. |
| Rice et al. (1984-Abstract) - Reproductive and teratogenic effects of isoflurane (ISO) in Swiss Webster (SW) mice. | Mice were exposed to either 0.006%, 0.06%, or 0.6% isoflurane for 4 hr daily on days 6-15 of pregnancy; on day 18 dams were killed to determine number of live and dead fetuses, and resorptions. | No difference in litter size or sex ratio; fetuses from 0.6 % isoflurane group showed weight loss, increased incidence of cleft palate, reduced skeletal ossification, minor hydronephrosis, and increased renal pelvic cavitation compared to control. | Clinical concentration (0.6%) of isoflurane, not the lower concentrations, is teratogenic. |
| Tannenbaum and Goldberg (1985) - Exposure to anesthetic gases and reproductive outcome. A review of the epidemiologic literature. | Review of epidemiologic literature for reproductive toxicity. | Inadequate evidence with significant flaws in the design and conduct of the observational studies. | Isoflurane reproductive toxicity is inconclusive. |
| Xu et al. (2012) - Effects of isoflurane inhalation on the male reproductive system in rats. | 15-day intact male rats were exposed to 0, 50, 300, 1800, and 10,800 ppm isoflurane and sacrificed to collect serum for hormones and testes for sperm count and histopathology and electron microscopy of spermatocytes. | Serum follicle-stimulating hormone and testosterone were reduced significantly at 1800 and 10,800 ppm isoflurane; daily sperm production were significantly decreased and seminiferous tubules were significantly impaired at 300, 1800, and 10,800 ppm; Ultrastructural changes included nucleus agglutination of spermatocytes, big lipid drops and autophagosome in cytoplasm. | Isoflurane induced impairments of seminiferous tubules and spermatogenesis in male rats. |

Appendix D

Categorization for Cancer and Reproductive Effects from Isoflurane (CAS # 26675-46-7)

| Authoritative Body | Notation/Classification |
|--|--|
| ACGIH | No notation, isoflurane is not listed at all |
| ATSDR | No notation, isoflurane is not listed; refers to CDC. CDC refers to NIOSH |
| IARC | Volatile Anaesthetics (Grp 3); Inadequate evidence for carcinogenicity to humans and inadequate evidence to animals. |
| NIOSH | No notation; no NIOSH exposure limits exist for isoflurane in humans. Animal studies indicate 1,500 ppm |
| NTP | No notation; no listing |
| OEHHA / Proposition 65 (cancer?, repro?) | No notation; no listing |
| US EPA IRIS | No notation; no listing |

References

ACGIH See ACGIH book, "TLVs and BEIs," Appendix A identifies the notations below that are included in the Threshold Limit (Adopted) Values (TLVs) for each listed substance.

ATSDR Refers to CDC. CDC refers to NIOSH.

IARC IARC Monographs on Evaluation of Carcinogenic Risks to Humans, volume 11 (1976), supplement 7 (1987), retrieved from <http://monographs.iarc.fr/ENG/Monographs/vol1-42/mono11.pdf>

NIOSH NIOSH Docket number 64 – 2011: NIOSH announced a request for information with the intent to review and evaluate toxicity data for the halogenated anesthetic agents: of isoflurane, desflurane, and sevoflurane for establishing a REL. Retrieved from <http://www.cdc.gov/niosh/docket/archive/docket064.html>

Waste Anesthetic Gases in Occupational Hazards in Hospitals (2007). DHHS NIOSH Publication No. 2007-151, retrieved from <http://www.cdc.gov/niosh/docs/2007-151/pdfs/2007-151.pdf>

Animal Studies criteria for a recommended standard ... occupational exposure to waste anesthetic gases and vapors (1977). DHEW (NIOSH) Publication No. 77-140D, p. 106-107. Retrieved from <http://www.cdc.gov/niosh/docs/1970/77-140.html>

NTP <http://ntp.niehs.nih.gov/pubhealth/roc/roc13/index.html>

OEHHA <http://www.oehha.ca.gov/> and http://www.oehha.ca.gov/prop65/prop65_list/Newlist.html

US EPA IRIS <http://cfpub.epa.gov/ncea/iris/index.cfm?fuseaction=iris.showSubstanceList>

Appendix E

Veterinary Health Partners Recruitment Questionnaire

Hi, _____ my name is _____ and I'm an (job title) in the Occupational Health Branch of the California Department of Public Health. I'm contacting you to introduce myself and our project on veterinary health hazards. The Occupational Health Branch conducts research about the nature and extent of workplace illness and injury, and recommends steps to prevent illness and injury among workers in California.

The goal of our Veterinary hazards project is to raise awareness about occupational exposures and to prepare educational materials regarding potential hazards and best practices used by staff to minimize hazardous exposures.

Would you have 10 minutes to speak with me about the need for our project?

Introduction:

The Occupational Health Branch has recently visited some hospitals and clinics become concerned that:

1. Occupational exposure to waste anesthetic gases, lead, and cadmium is not well-monitored or controlled in some hospitals and clinics
2. Staff may not be well-aware of the potential health hazards from exposures to waste anesthetic gases and metals.
3. There are ways to control exposures below the regulatory limits for waste anesthetic gases and hazardous metals.

We have also heard from the Cal/OSHA Consultation Service that hospitals and clinics lack awareness on some occupational health issues.

So, we would like to invite stakeholders to participate in advising us or participate with us in developing educational materials if needed. What is needed?

1. What health hazards does your job (work) involve? And/or Do you have health concerns related to your job?
2. What workplace health or safety issues would you like to receive more information about?

3. What would be the best form to receive this information?
- ☐ An in-person presentation in a small group in my workplace
 - ☐ Classroom training
 - ☐ A written pamphlet or booklet
 - ☐ A video
 - ☐ Topic page on the internet
4. If you want to know more about workplace safety, what resources do you use most often?
- ☐ My supervisor
 - ☐ My co-workers
 - ☐ Veterinary Associations, Groups
 - ☐ Newspapers and TV
 - ☐ Website
 - ☐ Internet _____
 - ☐ Training materials my employer has provided
 - ☐ Other _____
 - ☐ Don't know where to get information
5. What materials already exist regarding the occupational health hazards to veterinarians and vet techs?
6. What materials already exist regarding waste anesthetic gases?
7. Is there a need for educational materials in languages other than English? What language(s)?
8. What level of education do veterinary technicians in your facility have or in general?
9. Would you be willing to work with us on this project?

For workers:

10. Has your hospital/clinic already provided training to you on the hazards of waste anesthetic gases?
- a. Yes/no
 - b. How did they do it?
 - c. What do you remember about it?
 - d. When is the next training?

Appendix F

HESIS Team Meeting Agenda

Meeting P-3334 beginning at 1:15pm on Wednesday, July 29.

Educational Outreach to Veterinary Hospitals and Clinics

This meeting will discuss the means, methods, and modes of outreach
Review what has been done and what are possible options?

What prompted this concern about WAG in Vet Occupational Settings?

- HESIS experience in vet facilities (Kathleen)
- Interview of a Veterinary business owner (Tracy)
- Quick Summary of CalOSHA Consultations (Rick)

Interviews (Chrissy)

- Pres CaRVTA
- Interview Pres VetEquip

Who is the audience? Veterinarians, Vet hospital managers, and Vet Techs

Who are key stakeholders:

1. Ca Vet Med Board, CA Dept Consumer Affairs
2. CaRVTA
3. Other local vets and vet tech assoc.
4. Vet Tech colleges
5. Vet Med Teaching Hospitals
6. National Orgs: AVMA, NAVTA, SLAVT, AAHA

NEXT STEPS ... Communication Means, Methods, and Modes Considering

- 1) Video
- 2) Resource /Toolkit
- 3) Presentations:
 - i) CA Vet Tech Association recommended presentations at the following conferences:
 - (1) CaVMB
 - (2) CVC West (December 2015) <http://www.thecvc.com/dates-and-locations/cvc-san-diego/>;
 - (3) UC Irvine Conti Conference (August 2016) <http://www.bli.uci.edu/conti/>;

- (4) Back To School Conference UC Davis (June/July 2016) <http://www.vetmed.ucdavis.edu/CE/>

ii. UC Davis CEU powerpoint (powerpoint hosted at UC Davis, not live presentation)

- 4) Fact sheet
- 5) Revise and contribute to checklist for CA Vet Medical Board (licensing) inspections.

The Veterinary Medical Board should incorporate info re Cal/OSHA requirements into their checklist. The Hospital Standards Self-Evaluation Checklist was developed by the Veterinary Medical Board (Board) and its Multidisciplinary Advisory Committee with input from the public and profession in order to assist Hospital Directors' review of minimum standards to achieve compliance with the law. The Board strongly recommends involvement of the entire staff in a team effort to become familiar with and maintain the minimum standards of practice.

http://www.vmb.ca.gov/forms_pubs/hosp_insp_chklst.pdf

- 6) Article(s) for Board newsletters

[Also see the [O:\HESIS\HESIS Publications\Veterinary Hazards draft\StartingProjectQ&A - Vet Hazards 7-27-2015.docx](#)]

Supervised Field Training in Public Health
Scope of Work and Timeline

Project: Veterinary Hazards Project: Identify a need for and develop educational materials on occupational hazards in the veterinary industry.

| Goal 1: Learn about veterinary hospital and clinic occupational health and safety hazards. | | | | |
|---|---|----------------------|--|--|
| Project Objectives | Activities | Start/End Date | Who is Responsible | Deliverables |
| Learn about veterinary hospital and clinic occupational health and safety hazards. | a. Conduct a literature review on Waste Anesthetic Gas (WAG) - ongoing i. Help organize the literature review | May 1 - ongoing | Rick Votava and HESIS Team | 1. <u>Starting a Communication Project Q&A</u> 2. <u>Communications Project Planning Q&A</u> |
| | b. Identify significant occupational health hazards | May 1 - June 30 | Rick Votava and HESIS Team | Starting a Communication Project Q&A document. |
| | c. Review results from Cal/OSHA Consultation field visits | May 18 - June 19 | Rick | Prepare Table/chart detailing hazards found, Cal/OSHA regulation covering hazard, and number of facilities visited, time period of visits |
| | d. Search Authoritative bodies to identify classification of chemical hazards in veterinary work settings i. Tox.net ii. IARC - Kashyap Thakore, Staff Toxicologist iii. Proposal 65 (Prop 65) listings iv. What are effects of chemical hazards? v. Carcinogens? | May 1 - ongoing | Rick Votava, Kashyap Thakore, Staff Toxicologist, and HESIS Team | 1. Chart WAG and Isoflurane toxicities, Reproductive effects 2. Chart Categorization for Cancer and Reproductive Effects from Isoflurane 3. Chart on WAG and Isoflurane Potential Health Effects |
| Goal 2: Conduct key informant interviews | | | | |
| Conduct key informant interviews with workers, supervisors, representatives of regulatory agencies, professional organizations, and teaching veterinary hospitals and gather other background information to inform the development of educational materials on occupational health hazards in veterinary hospitals and clinics. Information sought includes: | Identify the target audience(s) [language, literacy level, cultural needs, learning styles, interests] | June 15 - August 15 | Rick Votava and HESIS Team | Use the U.S. Census Bureau, North American Industry Classification System (NAICS) to find how many workers and workplaces are affected. |
| | Identify key messages, brainstorm at team meetings | July 27 - August 15 | Rick Votava and HESIS Team | List of proposed message(s). |
| | Define the specific objective of the factsheet. What do we expect impact to be; i.e. change in knowledge, attitudes, and behavior/action? What do we want recipients to do with the information? | August 1 - August 25 | Rick Votava and HESIS Team | Message(s) to Veterinarians and Veterinarian Technicians |
| | What are the best ways to communicate the information? What media to use? Find and investigate educational products on websites. 1. Example: Preventing death from methylene chloride vapors (http://www.cdph.ca.gov/programs/ohb/Pages/methylenechloride.aspx) ii. View FACE (Fatal Assessment and Control Evaluation program) videos on OHB webpages. 1. Ascertain how hazards are communicated 2. Educational methods used | August 1 - August 25 | Rick, HESIS Team, Laura Styles, FACE Team lead | A. Find and investigate educational products on websites. 1. Example: Preventing death from methylene chloride vapors (http://www.cdph.ca.gov/programs/ohb/Pages/methylenechloride.aspx) B. View FACE (Fatal Assessment and Control Evaluation program) videos on OHB webpages. 1. Ascertain how hazards are communicated 2. Educational methods used |
| Goal 3: Conduct a needs assessment summary | | | | |
| Develop a needs assessment summary (Starting and Planning a Communication Project Q&A). Key Informant Interviews may include discussions with the following groups (examples only): | a. Veterinary Medical Board, b. American College of Veterinary Anesthesia and Analgesia, c. California Veterinary Medical Association (CVMA) d. California Registered Veterinary Technicians Association e. Hospital managers | | | 1. <u>Starting a Communication Project Q&A</u> 2. <u>Communications Project Planning Q&A</u> |
| Goal 4: Develop a needs assessment survey phone scripts | | | | |
| Develop needs assessment survey phone scripts to identify current knowledge of the veterinary industry of their occupational hazards and challenges regarding the control of occupational hazards. The phone script may include questions on training of employees, occupational hazards evaluation, and methods of control used in the veterinary industry. | Phone scripts / Interview questions shall be developed for the following: a. Veterinary hospital and clinic managers, b. Registered vet technicians (RVTs) c. Veterinarians d. Professional organizations of Veterinarians e. Professional organizations of RVTs f. Anesthesia Equipment Maintenance and repair companies g. How bad are the leaks? h. What are best practices to control leaks? iii. Can CDPH get copy of maintenance and education materials? g. Different scripts for Veterinarians, RVTs, animal care workers, and contracted equipment maintenance companies | May 18 - August 15 | Rick Votava and HESIS Team | Interview scripts for different groups: Veterinarians, Veterinarian Technicians; Registered Veterinarian Technicians Association; Veterinary Associations; and Veterinarian Equipment providers |
| Goal 5: Summarize information from Cal/OSHA on the veterinary hazards found by Cal/OSHA in a single page table. | | | | |
| Summarize information from Cal/OSHA on the veterinary hazards found by Cal/OSHA in a single page table. | a. produce table | May 1 - June 15 | Rick Votava | Table of Cal/OSHA findings |
| Goal 6: Complete Starting and Planning a Communication Project form and reply to feedback | | | | |

| Project Objectives | Activities | Start/End Date | Who Is Responsible | Deliverables |
|--|--|---------------------|----------------------------|---|
| With assistance from the Veterinary Hazards Project Team, complete the <u>Starting and Planning a Communications Project</u> forms and reply to feedback. | | May 1 - July 31 | Rick Votava | <u>Starting and Planning a Communications Project Planning Q & A</u> document |
| Goal 7: Develop a plan with timeline for the educational materials development project. | | | | |
| Develop a plan with timeline for the educational materials development project. a. Week by week timeline | a. Week by week timeline | May 1 - ongoing | Rick Votava | Timeline |
| Goal 8: Complete Communication Project Planning Q & A | | | | |
| Complete <u>Communication Project Planning Q & A</u> . | | June 5 - ongoing | Rick Votava and HESIS Team | <u>Starting and Planning a Communications Project Planning Q & A</u> document |
| Goal 9: Visit at least one veterinary hospital or clinic to observe anesthetic gas exposure | | | | |
| Visit at least one veterinary hospital or clinic to observe anesthetic gas exposure. | a. Administer the confidential survey to workers. Adapt from sample surveys. b. Administer the confidential survey to hospital managers and supervisors. | June 29 - ongoing | Rick Votava and HESIS Team | Visit Oakland Zoo veterinary hospital; part of the American Association of Laboratory Animal Science (AALAS) visit. |
| Goal 10: Undertake qualitative and quantitative data analysis that describes and analyzes the survey questionnaire information and data collected and summarizes it into a report. | | | | |
| Undertake qualitative and quantitative data analysis that describes and analyzes the survey questionnaire information and data collected and summarizes it into a report. | a. The report will also provide findings and recommendations that will help to inform and provide guidance to HESIS and to the veterinary industry on ways to better protect their members from occupational health hazards. | May 1 - August 25 | Rick Votava | 1. <u>Starting a Communication Project Q&A</u> 2. <u>Communications Project Planning Q&A</u> |
| Goal 11: Develop an educational product | | | | |
| Develop an educational product (which may possibly be field-tested) including a worker educational material or activity for trainings in English that information on the potential hazard and ways to reduce the hazard. | a. Develop in accessible language in English | July 27 - August 25 | Rick Votava and HESIS Team | Similar but different fact sheets aimed at Veterinarians and Veterinarian Technicians. |
| Goal 12: Participate in and lead regular HESIS meetings. | | | | |
| Participate in and lead regular HESIS team meetings. | | May 1 - August 25 | Rick Votava and HESIS Team | Rick Votava Team Lead for HESIS Team meetings. |
| JULY | | | | |
| Goal 13: Begin field interviews with 2+ HESIS team members | | | | |
| Begin field interviews with 2+ team members for each interview. | Conduct key Informant interviews | June 1 - August 25 | Rick Votava and HESIS Team | Participate in key informant interviews. |
| AUGUST | | | | |
| Goal 14: Other Opportunities | | | | |
| As other opportunities to learn about occupational health hazards arise, Richard will be encouraged to attend seminars, webinars, site visits and other education events as well. | | May 1 - August 25 | Rick Votava | Attend and learn occupational health as seminars, webinars, site visits, and other educational events occur. |
| Goal 15: Participate in team meetings to develop educational materials | | | | |
| Richard will be encouraged to participate in team meetings on development of other educational materials as opportunities arise. | | May 1 - August 25 | Rick Votava | Rick Votava Team Lead for HESIS Team meetings. |